

# **Case History: Utilization of Resources for Natural Icing Flight Test Program**

**Presented to the SAE/FAA In-Flight  
Icing/Ground De-Icing  
International Conference**

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# **Natural Icing Flight Test Program Goal**

**Correlation between the forecast icing  
conditions, the actual icing conditions  
and the type and amount of ice  
accreted on the aircraft**

# Background

Airworthiness Directive (AD)2000-02-25  
Issued February, 2000

Affecting All General Aviation Aircraft With Deice Boots

Intent of AD: To Mandate That Pilots Activate Deice Boots  
At the Initial Onset of Icing and Leave the  
Deice System in “AUTO” Until Icing  
Conditions Have Been Exited to Reduce  
Pilot Workload

# MHI Concerns

- Flight Testing Had Not Been Conducted by the FAA to Verify the Conditions of the AD
- Ice Bridging, While Thought to be Non-existent for Later, Higher Pressure Boots, Was Not Proved to be a Non-event by In-Flight Tests
- Intercycle Ice on the Leading Edges of the Wing and Tail Had Not Been Evaluated
- Would the “AUTO” Mode for Deice Boots be Satisfactory or Would a Drag Increase Result If Going from the Old Procedure to the New Procedure for Deicing the Wing and Tail

# The Aircraft

**Mitsubishi MU-2B-60 “Marquise”**

**Manufactured:  
1979**

**Engines:  
Garrett 331-10  
715 SHP**

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**∴ MU-2 Produced  
In 1966**

**∴ 703 Built**

**∴ Over 400  
Still in Service**



# The Equipment

## Rosemont (BFG) Ice Detector

**Probe Location  
(Exterior)**



**Cockpit Display  
(Interior)**



# Personnel Participating

- Meteorologists
- Pilot
- Co-Pilot/Project Manager
- Engineer/Data Analyst
- Videographer

# Video Presentation

The background is a dark blue gradient. A thin, light blue curved line starts from the top left and arcs towards the center. A larger, lighter blue wedge-shaped area is positioned on the right side, pointing towards the center.



# Results

- **Real-time Internet Weather and Icing Tools Make This Type of Project Less Costly**
- **Normal Phone Lines Used, High Speed Internet Access Would Have Been Useful**
- **Fee-based Services Worth the Expense to Obtain Near Real-time Data**
- **Communications Essential**
- **Extremely Successful, Icing Encountered on Every Flight**

# Conclusions

- **Utilization of the New FAA Deicing Procedure is Acceptable for the MU-2 Series Aircraft**
  - *Intercycle Ice on the Leading Edges of the Wing and Tail Does Not Appreciably Affect Performance*
  - *Ice Bridging Does Not Occur*
  - *A Higher Level of Safety is Achieved When Operating in Icing Conditions*
- **Use of ICEX on the Deice Boots Significantly Improves Ice Shedding Capability**
- **Real-time Contact with Meteorologists Can Reduce Flight Time and, Therefore, Reduce Costs for Conducting Icing Flight Test Programs**

# Comments On Icing Flight Tests

- Don't Try This At Home, But If You Do...
  - Always Have an OUT!
  - Plan, Plan, Plan and Then Plan Some More
- If We Have the Tools to Find Icing Conditions By Utilizing These Methods, Then Conversely, We Have the Tools to Avoid Icing Conditions

# Propeller Ice

The background is a gradient of blue, transitioning from a bright blue on the left to a dark blue on the right. A thin, light blue curved line starts near the top left and arcs towards the center. A wedge-shaped area, colored in a medium blue, points from the right edge towards the center, partially overlapping the curved line.

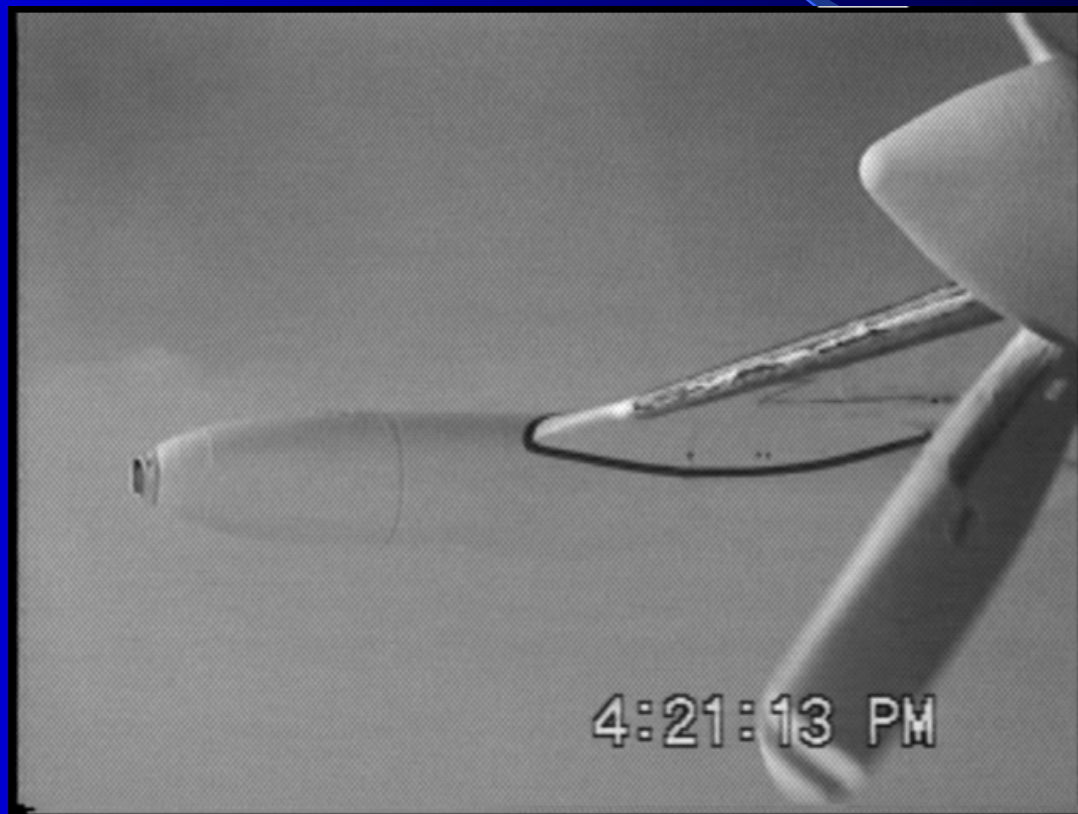
# Propeller Ice



# Propeller Ice



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# Propeller Ice



# Propeller Ice Effects

Propeller Efficiency Will be Reduced

Propeller Governor Will Try to Maintain RPM by  
Decreasing Blade Angle

Airspeed and/or Altitude Must Decrease or  
Power Must Increase (If Available)

# Propeller Ice Effects Considerations

More Research Should be Conducted in this  
Area

Could Explain Dramatic Loss of Airspeed for  
Certain Accidents

What Can be Done to Prevent Propeller Icing?



# Thank You

